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Indigenous chicken production in Kenya: II. Prospects for research and development

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Poultry production and in particular indigenous chicken (IC) production has been recognised as an avenue to improve livelihoods of the rural households. Previous attempts to improve their productivity have had little success due to, among others, lack of a holistic approach in solving the constraints and dissemination of inappropriate technologies given the production circumstances and market dynamics. Marketing as a constraint is often blamed for the failure of interventions to improve livelihoods, despite lack of saturation for IC products at local and national levels and the increasing demand for the same. This paper highlights the past improvement attempts and suggests strategies to improve IC productivity and thereby improve the livelihood of the rural households which are the custodians of these genetic resources. It is concluded that there is potential for improvement of IC production in Kenya given the available genetic and physical resources. However, a holistic strategy that increases productivity without increasing production costs or leading to loss of biodiversity must be developed. Such a strategy must take into account the various uses of the IC in a rural household.

Keywords: indigenous chicken production; production constraints; research and development; Kenya

Introduction

Improvement of the low productivity of indigenous chicken (IC) in developing countries has been the main focus of poultry development initiatives reported by various authors (Safalaoh, 2001; Copland and Alders, 2005; Guerne-Bleich *et al.,* 2005; Mack *et al.,*

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2005; Riise *et al.,* 2005). Studies in Kenya have identified constraints to increased productivity of IC as low genetic potential of the chickens, inadequate nutrition and disease outbreaks (Ndegwa *et al.,* 1998; Okitoi *et al.,* 2000a; Kaudia and Kitalyi, 2002). Previous attempts to address these constraints have had little success due to, among others, lack of a holistic approach in solving the constraints and dissemination of inappropriate technologies given the production circumstances and market dynamics. Marketing has also been mentioned as a constraint and is often blamed for the failure of interventions to improve livelihoods, despite lack of saturation for indigenous products at local and national levels and the increasing demand for the same (Riise *et al.,* 2005).

Various efforts aimed at improving egg and meat production have been attempted (Nyange, 1995; Okitoi, *et al.,* 2000a; Juma and Ondwasy, 2002). However, these efforts have yielded little success. Instead of improving productivity and rural livelihoods, the attempts have resulted in creation of new challenges such as increased production costs due to high costs and unavailability of inputs, marketing due to poor organization and erosion of chicken genetic resources. The rationale and weaknesses of the past improvement efforts must therefore be clearly understood before a possible holistic approach is discussed. This paper examines the past attempts at IC improvement in Kenya and explores the prospects and possible intervention measures for their utilisation, production and marketing for improved livelihoods and conservation.

Past performance improvement efforts

Available documented evidence suggests that attempts to increase IC production performance in East Africa began with the European settlers in Tanzania and later in Uganda (French, 1942; Trail, 1962). It was then stated that under the normal native management and conditions, the chickens matured late, laid a poor number of undersized eggs and yielded small carcasses (French, 1942). To improve the performance, crossbreeding with Rhode Island Red, White Leghorns, Light Sussex and Black Australorp European breeds was initiated.

In Kenya, improvement attempts probably began in 1974 when the first national effort to develop the poultry sector was initiated and the National Poultry Development Programme (NPDP) started (Anonymous, 1976). Broiler and egg production from commercial hybrids were emphasised due to the perceived need to organise, promote and develop small-scale commercial chicken production in the country (Anonymous, 1981). The programme goals were to increase small-scale farmer's income and protein intake through commercialisation of rural chicken production. Production of eggs and meat using commercial hybrid broilers and layers was started on pilot basis in a few rural areas. However, this approach was found to be uneconomical and was quickly abandoned, citing poor marketing channels as the major constraint (Anonymous, 1985). The focus turned to IC but their genetic potential to produce eggs and meat was considered to be too low to meet the goals of the programme.

Upgrading the IC using the so called high producing European breeds was seen as the quickest way of achieving genetic improvement thus increasing egg and meat production. Consequently, the cockerel and pullet exchange programmes using the Rhode Island Red breed were started (Wainaina, 1994). To support the genetic improvement, Newcastle disease (NCD) control through mass vaccinations and training of staff and farmers on chicken management were part of the activities before the actual exchange took place. However, lack of a constant supply of purebred cockerels and pullets become a constraint soon after, leading to the use of terminal hybrid cockerels from the commercial layer and broiler industries. As seen in Ethiopia (Tadelle *et al.,* 2000) and Malawi (Safalaoh, 2001) where a similar genetic improvement approach was used, and despite a recent study by Magothe *et al.* (2006) indicating a possible egg weight improvement, the desired egg production and growth rate improvements were not achieved (Hoyer, 1992). This was mainly because most of the exotic cockerels and their progeny could not survive the prevailing backyard conditions.

Due to the immense potential of IC to increase income, improve nutrition and hence alleviate rural poverty (Upton, 2000), further efforts to increase performance through better nutrition and health management have also been attempted (Chemjor, 1998; Okitoi, 2000; Siamba *et al.,* 2000; King'ori, 2004). Feed supplementation using locally available resources to cover nutrient deficits, conventional disease control measures and proper housing strategies have been shown to improve growth rate, age at point of lay and egg production, and decrease mortality respectively, thus leading to improved production (Okitoi and Mukisira, 2001; King'ori, 2004). However, in rural areas, these strategies have not been adopted. They are uneconomical mainly due to the high costs of inputs required relative to the potential incomes derived from the resultant outputs. Backyard IC production systems still have the highest returns on investment (Okitoi *et al.,* 2000b; Juma and Ondwasy, 2002; Menge *et al.,* 2005).

Prospects for research and development

Rural households are characterised by their high poverty due to low income, coupled with food insecurity. They engage in production enterprises that require low capital investments (Permin *et al.,* 2001). Activities requiring high capital investments can therefore not be adopted without subsidies. Although IC has the potential to create rural wealth and supply food, and hence reduce absolute poverty, efforts to increase production should not only consider the economic roles but also other uses of the chickens in a household under the prevailing production conditions (Riethmuller, 2003; Riise *et al.,* 2005).

The notion that improvement can only be achieved by enhancing general management, disease control, marketing strategies and use of the so called new high-yielding exotic breeds is self-defeating (Upton, 2000). Apart from increasing production costs that cannot be met by the rural poor, these strategies have led to dilution and possible loss of genetic biodiversity (Maina *et al.,* 2000; Nyaga, 2007). The statement by Branckaert (2007) that 'it is to be feared that, in the future, the national authorities - in order to please funding agencies - choose the easiest path, namely the destruction of their traditional poultry-farming sector to the detriment of the small farmers, which could mean an increase in the impoverishment of these already underprivileged social players' summarises the situation.

GENOTYPE/STRAIN UTILISATION

Although little is known about the genetic make-up, general characteristics and production and reproduction performances of available IC genotypes, evidence in literature shows that genotypes (both exotic and indigenous) possessing the naked-neck and frizzle genes, either singly or in combination have led to increased growth rates, superior body weights, better feed conversion, higher egg production and disease tolerance in tropical environments (Fraga, 2002; Adedeji *et al.,* 2006; Nwachuckwu *et al.,* 2006; N'dri *et al.,* 2007; Islam and Nishibori, 2009). The genotypes are able to utilise poor quality feeds and withstand high ambient temperatures characteristic of free-range production system. In Kenya, these genotypes are predominant in such warm and humid or hot and dry regions of the country. In addition, the frizzle genotype is associated with cultural practices in some communities (Njenga, 2005). Utilizing the naked-neck, frizzle or naked-neck-frizzle genotypes for meat or for dual purpose production in such environments and communities would be expected to increase live bird offtake and egg yield without additional cost increases. Furthermore, the Kuchi genotype, similar to the Kuchi ecotype of Tanzania (Msoffe *et al.,* 2001) and the Aseel genotype of Bangladesh (Bhuiyan *et al.,* 2005), would be ideal for meat production in warm and humid low population density areas. The bird has game chicken characteristics and would thus be better able to evade or fight off predators.

The dwarf gene is known to increase feed efficiency and egg mass production (Garces *et al.,* 2001; Yeasmin *et al.,* 2003). These birds have a lower feed intake due to reduced body size and produce more eggs and less meat than their normal counterparts under farm conditions (Rashid *et al.,* 2005). A recent study by Magothe *et al.* (2010a) showed that the naked-neck, frizzle and crested-head genes influenced body weights and growth patterns of IC. The authors noted that the crested-head genotype was lighter and had a lower growth rate than the normal-feather genotype when subjected to the same level of management. Given that growth rate and egg production are negatively correlated, they speculated that the crested-head genotype could be a superior egg producer. Therefore, utilising these genotypes would also increase egg production without additional cost increases. Introducing the crested, naked-neck or frizzle genes into the dwarf genotype would be expected to improve egg production under all production systems.

The beard (ear tufts) and feathered-shank (ptilopody) are adaptations to cold environments (Bartels, 2003). Although information on the bearded genotype is scarce in literature, the ptilopody gene has been shown to increase body weight and egg mass (Fayeye *et al.,* 2006). These genotypes would therefore increase egg and meat productivity in very cold environments of the country. Utilising these genotypes in environments where they are best adapted would not only be in tandem with the socio-cultural uses of the birds but would also increase productivity and conservation (Nimbkar *et al.,* 2008).

GENETIC IMPROVEMENT OF INDIGENOUS CHICKENS

Apart from upgrading of IC through crossbreeding, genetic improvement can also be achieved through selective breeding. In most species of livestock, vast changes in performance have occurred over recent decades. A major part of this change is genetic, produced by selection between and within populations (Maki-Tanila, 2007). This method has been used to develop the so called high yielding exotic breeds and hybrids (Siegel *et al.,* 2006). It has also been used to develop the IC in Egypt (Hossary and Galal, 1995; Kosba *et al.,* 2006) and Iran (Kamali *et al.,* 2007). However, selection is dependent on the presence of sufficient genetic variation for a given trait in a population. The general improvement direction is described as a breeding objective that answers the question 'where do we want to go?' (Kahi *et al.,* 2006). Indigenous chickens possess high genetic diversity for many important traits that can be selected in a breeding programme (Mukherjee, 1990). Genetic improvement programmes are based on accurate estimates of variance components and genetic parameters for economically important traits described in the breeding objective on which selection and mating decisions are made (Kahi *et al.,* 2006). Magothe *et al.* (2010b) and Ngeno *et al.* (2011) have estimated genetic parameters for egg weight and body weights of IC in Kenya that can be used to initiate a breeding programme. A much taunted reason for not implementing selective breeding programmes has been the fact that progress is usually slow. However, the resultant changes are always permanent and cumulative (Cunningham, 1979).

Indigenous chickens are active, hardy and have better ability to withstand disease challenges associated with backyard conditions than chickens from temperate regions (Horst, 1988). They are also known to be aggressive and highly protective of their young from predators, possess excellent brooding and foraging ability, and can utilise high fibre diets, in addition to being tolerant to extreme temperatures (Fraga, 2002). All these traits are important for the free-range and semi-intensive systems. Ability to lay more eggs and grow faster can be improved without losing other important characteristics like unique product qualities, disease resistance and adaptability (Maki-Tanila, 2007). Chicken genotypes and strains possessing ability to utilise high fibre feed more efficiency and those tolerant to diseases can be selectively bred. Such birds would be able to increase production without expensive feed supplementation or health management. To achieve this, clear breeding objectives and strategies that address needs and circumstances of a particular production system utilising particular genotypes must be well defined (Djemali and Wrigley, 2002). In Kenya, traits of economic importance to producers under different production systems have been defined and breeding objectives developed (Menge, 2009). However, there is need to identify IC genotypes which are superior in traits in the breeding objectives and develop breeding strategies to be used in dissemination of the improved genes. This can only be achieved if trait recording, performance testing and breeding value estimation are undertaken.

To implement this genetic improvement method, research input is mandatory. Fortunately for the country, poultry research facilities and knowledgeable manpower are available (Kahi *et al.,* 2006; Nyaga, 2007). The relevant policies and guidelines are in place or are in the process of being formulated (GOK, 2007; MOLD, 2008). What lacks is the capital resource to undertake the improvement programme. Such a programme should be funded from public funds and coordinated by the relevant government ministry.

DISEASE CONTROL

Disease outbreaks such as NCD, fowl typhoid, Gumboro and fowl pox have been found to account for over 50% of the IC loss in Kenya (Olwande *et al.,* 2010). This is because most of the IC are raised under extensive system of production characterised by free mixing of birds of all ages during scavenging. Extensive production systems exposes the chickens to harsh environmental conditions that increase likelihoods of infection and transmission of diseases thus resulting to high mortalities (Abdelqader *et al.,* 2007; Kaingu *et al.,* 2010; Olwande *et al.,* 2010). Although most farmers do not vaccinate or treat their chickens, a few use herbs, paraffin oil and, in extreme cases, human antibiotics for treatment. To overcome high mortalities due to diseases, proper control mechanisms on IC health coverage and vaccination programmes need to be undertaken. Such programmes have improved rural chicken production in Pakistan (Javed *et al.,* 2003).

Although the use of ethnoveterinary medicine has also been recommended, this might not be sustainable because there is continuous loss of local indigenous knowledge through generations, deforestation and climate change, which might result in extinction of some herbs being used. Breeding for disease resistance is a better option of disease control in that once achieved, it is expected to be permanent and passed on to future generations. Enhanced genetic resistance through selective breeding represents an under-exploited low cost opportunity for disease control in low input IC production systems. However, improvement in resistance should be undertaken whilst enhancing productivity.

FEEDING AND GENERAL HUSBANDRY

The productivity of the IC can be improved by providing appropriate housing, disease control and good nutrition (Ndegwa and Kimani, 1996). Indigenous chicken feeding is mainly based on scavenging with supplementation during wet seasons and little or no supplementation during dry seasons. Previous studies have shown that free-range chickens can fulfil their nutritional requirements for proteins, vitamins and minerals. However, this is dependent on scavenging area per bird, quality of the scavengeable feed resources, season and production stage (Abdelqader *et al.,* 2007).

In Kenya, supplementation of the IC is a common practice among farmers (Birech, 2002; King'ori *et al.,* 2003; Olwande *et al.,* 2010). The chickens are supplemented mainly with cereal crops which are abundant during the wet seasons and scarce in dry seasons. Alternative strategies should be developed in order to reduce the competition between humans and chickens for cereals during the dry seasons. There is a need for research on drought-tolerant cereals crops which can mature during short rain periods. This would provide surplus cereals which can be used to supplement the chickens. There is also the need to determine quality of grains especially during the dry season. It has been estimated that through scavenging, IC are able to fulfil 8.5g/kg/day of their total 11.7g/kg/day of protein requirement and therefore should be supplemented with 3.5g/kg/day (King'ori *et al.,* 2007). Although information on the energy requirement for the scavenging chickens in Kenya is scarce, studies from the neighbouring Ethiopia indicate that they require about 286 Kcal/day (Dessie, 1996).

In the field, IC scavenge on feed resources such as insects *e.g.* termites (Mwamachi *et al.,* 2000; Birech, 2002), which are rich in proteins. There is a need to carry out research on termites as an alternative source of feed for the IC. Research should be done to determine their nutritional value and conventional strategies to harvest them. Feeding termites to IC provide a mechanism for converting unusable cellulose into food for human consumption with benefits to the ecosystem. Termites thrive well in dry conditions and mostly feed on dead plant products generally in the form of wood, leaf litter, soil, or animal dung. Their recycling of wood and other plant products is of considerable ecological importance. Urgent development of methodologies and techniques to convert termites into food for humans is a critical step in sustaining the IC sub-sector especially under climate variability. Such efforts will also lead to environmental protection by ensuring that a large fraction of the net primary production is converted into consumable biomass by domesticated animal species.

MARKETING AND INFORMATION DISSEMINATION

The demand for IC has been increasing and is expected to grow given the increasing population growth, urbanisation and economic development. The increasing numbers of supermarkets in urban centres offer opportunities for producers to fetch premium prices for their products. However, a majority of producers are still not able to capture a share of this market due to the very high quality conditions required. There is ample evidence that producers' willingness to increase productivity is closely linked to existence of efficient markets for their produce (Gausi *et al.,* 2004). As indicated earlier, whereas the prices of eggs are relatively stable, that of live birds fluctuates drastically due to supply and demand at various seasons. Although value addition processes are on the increase, the free-range production system has not yet benefited. This implies that producers and traders can either confine themselves to business as usual markets or move towards collective actions to supply consumer quality demanded products to these emerging markets.

Utilisation of adapted genotypes that the producer is comfortable with would be the first step towards commercialisation of the free-range production system (Guerne-Bleich *et al.,* 2005). Creation of interdependent partnerships between producers, traders and market outlets would be the next step. Business contracts can be established between existing traders (assemblers, itinerant, processors and retailers) and producers (common interest groups and farmer field schools). The producers would undertake to supply a given quantity of eggs or live birds to a particular trader or traders at specific timeframes, while the traders would undertake to collect the products at an agreed price. This should then be replicated along the marketing chain up to the retailers. To meet the quantity agreed upon, each producer within a group can specialise in production of one type of product, either eggs or live birds. This calls for effective sensitisation and capacity building through training (Copland and Alders, 2005; Alders and Bagnol, 2007). With specialisation, meeting the consumer demanded quality would be easy and a stable regular market would thrive, leading to increased income for the producer.

PRODUCER TRAINING AND EDUCATION

Education of farmers has been found to be one of the major factors affecting adoption of new technologies (Saha *et al.,* 1994). Generally farmers with higher education have better access to knowledge and information that are beneficial to farm management hence profitability. The majority of the IC producers in Kenya, as in other developing countries, are illiterate (Njenga, 2005; Halima *et al.,* 2007). This hinders efficient communication thus limiting their bargaining potential during trade and the ability to train in animal management and other related aspects. There is a need to focus on farmer's education and training in the areas of chicken breeding, feeding, diseases and parasites control and treatment and marketing. Training and education should be tailored to both sexes but the major focus should be on women as they play a major role in IC production systems (Halima *et al.,* 2007; Olwande *et al.,* 2010). Using bottom-up training approach, simple and unconventional teaching methods such as songs, theatre and learning by doing should be used to pass simple extension messages (Guèye, 2002).

POLICY REVISION TO ENHANCE IC PRODUCTION

The demand for IC products has been increasing in the urban setups while supply from the rural areas has not grown in tandem with this demand due to various constraints such as land subdivision, lack of feeds, outbreak of diseases, poor marketing linkages etc. The increasing human population in Kenya coupled with declining land sizes per family has negatively affected the cereal crops production which is the major feed source for the IC. This has led to competition for cereals between humans and animals.

The market channels for IC in developing countries are informal where middlemen pass through the villages and buy chickens and chicken products in dozens and later resell them at hotels or main urban centres at a profit (Gausi *et al.,* 2004). These middlemen tend to exploit producers by paying them low prices since the producers do not have access to market information. This calls for the review of policies governing livestock trade and marketing to protect the producers from extortion and exploitation by middlemen and enhance market competition. This can be achieved by encouraging IC producers to form registered organizations. These organizations will help them in market research thereby fetching good prices for their products. There is a need also to strengthen the vaccination and disease control policy not only to the large stock but also to chickens. Through vaccination, diseases like NCD, Infectious Bursal Disease (IBD) and fowl pox, which kill large number of IC during outbreaks, can be prevented (Mwamachi *et al.,* 2000).

INFRASTRUCTURE DEVELOPMENT

Indigenous chicken production is mainly concentrated in the rural areas of Kenya (Ndegwa *et al.,* 1998; Okitoi *et al.,* 2000a; Kaudia and Kitalyi, 2002). These areas are characterised by poor infrastructural facilities such as road and telecommunication networks. Installation of these facilities would open up these areas for development (Kilungo and Mghenyi, 2001) and enhance ease of access by the producers to markets and input supplies. Construction of roads would help the extension service providers to reach as many producers as possible allowing training on new production technologies which will result in increased productivity of the IC.

FORMATION OF NETWORKS

The IC farmers in Kenya, as in other developing countries, are faced with several challenges such as disease and parasite outbreaks, feeding, breeding, housing, marketing and lack of credit facilities. These problems can be solved through well-designed and implemented information dissemination programmes that endow all the stakeholders in IC sector with necessary knowledge and skills (Guèye, 2009). This calls for formation of IC networking programmes which will enable farmers to acquire and share knowledge, views and experiences among themselves and with all other stakeholders along the IC value chain.

Networks are important especially where the extension workers do not focus on IC production, while researchers and policy makers do not have direct contact with farmers. Lack of contact with farmers arises due to the fact that there are very few researchers dealing with IC *vis a viz* the numerous number of farmers with small flocks who live in rural areas characterised by poor road networks. There is the need to establish vibrant IC networks that will help farmers to develop and change their attitude and knowledge and make informed decisions. Networks should be developed that bring together researchers, policy makers and farmers. This will help the researcher and policy makers to know how the problems encountered by IC farmers, current policy and regulations affect IC farmers and which changes can be made to improve their situation. It should be noted that for the networks to be sustainable and efficient, all stakeholders should participate voluntarily and, have a feel of self-motivation and sense of ownership.

Conclusions

There have been previous attempts to address constraints to IC production in Kenya. These attempts have had little success due to, among others, lack of a holistic approach in solving the constraints and dissemination of inappropriate technologies given the production circumstances and market dynamics. This review has suggested strategies to improve the IC productivity which could improve the livelihood of the rural households who are custodians of these genetic resources. It is important that the role of participants in the production chain is clearly specified and their positions well established. There is potential for improvement of IC production in Kenya given the available genetic and physical resources. However, a holistic strategy that increases productivity without increasing production costs or leading to loss of biodiversity must therefore be developed. Such a strategy must take into account the various uses of the IC in a rural household.

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